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USACE / NAVFAC / AFCESA **UFGS-L-07550N (February 2002)**

Preparing Activity: NAVFAC **Replacing UFGS-07550N (01/02)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

Use for LANTNAVFACENGCOM projects only
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SECTION 07550N

MODIFIED BITUMINOUS MEMBRANE ROOFING

02/02

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SECTION 07550N

MODIFIED BITUMINOUS MEMBRANE ROOFING
02/02

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NOTE: This guide specification covers requirements for modified bitumen sheet roofing, both APP modified for torching, SBS modified for hot mopping and SBS modified for cold application, with a minimum slope of one in 48 1/4 in./ft. This guide specification does not include the structural roof deck, insulation, or sheet metal fascias, gravel stops, and flashings. Acids, hydrocarbons, oil, and cooking greases attack modified sheet roofing. When these contaminants may be a problem on a roof, contact modified bitumen sheet manufacturers for specific recommendations.

Comments and suggestion on this specification are welcome.Use of electronic communication is encouraged. Email comments to LantDiv@efdlant.navfac.navy.mil.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.
****

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NOTE: This revision "" to NFGS-07550 follows a complete review of the previous version. The text is revised throughout, according to that review.
****

****
NOTE: On the drawings. show:

1. Roof-penetrating components such as roof drains and vents. Do not place within 450 mm 18 inches of each other or from toe of cant strip at juncture of roof and wall or other vertical surface.

2. Roof drains. Provide with approved clamping rings and removable large dome strainers.

3. Roof-mounted equipment. Mount on curbs or structural supports of sufficient height to accommodate flashings and installation of roofing

under the equipment. Provide circular structural supports (pipe columns) to greatest extent practicable to permit use of circular collars with flashing flanges and umbrella flashing with clamping rings. Do not allow curbs to restrict drainage of water from roof.

4. Expansion joints in roofing. Provide at each expansion joint in structure. Place on curbs above water line. Do not restrict drainage of water from roof.

5. Area dividers in roofing:

a. At high points where practicable Do not obstruct drainage of water from roof. Place on curbs above water line.

b. Where roof deck changes direction and where substrate materials change.

c. Uniformly space not over 60 meters 200 feet apart on section of roof that exceeds 60 meters 200 feet in length or width.

d. At each intersection where L- or T-shaped roof deck changes direction.

e. At difference in elevation between adjoining decks.

6. Details for items mounted on or penetrating roof membrane and at points requiring atypical flashing; use isometric drawings to clearly indicate intersections of different types of flashings.

7. Slope of roof with directional arrows.

8. Wood nailers for backnailing of felts on non-nailable deck:

a. Spaced no more than 6400 mm 21 feet apart, same thickness as insulation, and at right angles to slope on decks with insulation.

b. Spaced no more than 6400 mm 21 feet apart, embedded flush with deck top surface, and parallel to slope on decks without insulation.

c. At right angles to roof slope of ridged roofs, spaced and installed as for decks with or without insulation, as applicable.

9. Live load limits of roof construction.

10. Roof walkways for traffic areas and access to mechanical equipment. Provide openings in walkways to permit drainage of water from roof.

****

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 41	(1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 226	(1997) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 228	1990a (Reapproved 1996) Standard Test Methods for Asphalt Roll Roofing, Cap Sheets, and Shingles
ASTM D 312	(1995; Rev. A) Asphalt Used in Roofing
ASTM D 1863	(1993; R 1996) Mineral Aggregate Used on Built-Up Roofs
ASTM D 2170	(1995) Kinematic Viscosity of Asphalts (Bitumens)
ASTM D 2178	(1997 Rev. A) Standard Specification for Asphalt Glass Felt used in Roofing and Waterproofing
ASTM D 4402	(1987; R 1995) Viscosity Determinations of Unfilled Asphalts Using the Brookfield Thermosel Apparatus
ASTM D 4479	(2000) Asphalt Roof Coatings - Asbestos-Free
ASTM D 4586	(1993) Asphalt Roof Cement, Asbestos-Free
ASTM D 4601	(1997; Rev. A) Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
ASTM D 4897	(1997; Rev. A) Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing
ASTM D 5147	(1997) Standard Test Method for Sampling and Testing Modified Bituminous Sheet Material
ASTM D 5849	(1995) Standard Test Method for Evaluating Resistance of Modified, Bituminous Roofing Membranes to Cyclic Joint Displacement
ASTM D 6162	(1997) Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using

	a Combination of Polyester and Glass Fiber Reinforcements
ASTM D 6163	(1997) Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements
ASTM D 6164	(1997) Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
ASTM D 6298	(1998) Standard Specification for Fiberglass Reinforced Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheets with a Factory Applied Metal Surface.
ASTM E 108	(1996) Fire Tests of Roof Coverings

FACTORY MUTUAL ENGINEERING AND RESEARCH CORPORATION (FM)

FM A/S4470	(1986; R 1992) Class I Roof Covers
FM P7825	(1998) Approval Guide

UNDERWRITERS LABORATORIES INC. (UL)

UL RMSD	(1997) Roofing Materials and Systems Directory
UL 790	(1997) Fire Resistance of Roof Covering Materials

1.2 SUBMITTALS

****

NOTE: Where a "G" in submittal tags follows a submittal item, it indicates Government approval for that item. Add "G" in submittal tags following any added or existing submittal items deemed sufficiently critical, complex, or aesthetically significant to merit approval by the Government. Submittal items not designated with a "G" will be approved by the QC organization.

****

Submit the following in accordance with Section 01330, "Submittal Procedures." Refer to paragraph entitled "Quality Assurance" for further submittal requirement explanation.

SD-03 Product Data

Modified Bitumen Sheet G

Felts

Primer

Asphalt roof cement

[Cold-Applied Adhesive]

Fasteners

****
NOTE: Delete "Coating" when mineral granules are specified.
****

[Coating]

Roof and Deck Insulation

Sample warranty certificate G

****
NOTE: Do not include this paragraph for projects in the SOUTHNAVFACENGCOM area.
****

[Moisture release vents]

****
NOTE: Include paragraph or bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.
****

[asphalt]

SD-07 Certificates

Qualification of manufacturer

Qualification of applicator

Warranty Application

****
NOTE: Include paragraph or bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.
****

[Bill of Lading]

SD-08 Manufacturer's Instructions

Torches

modified bitumen sheet

Felts

Primer

[Cold-Applied Adhesive]

Asphalt roof cement

Fasteners

****
NOTE: Delete "Coating" when mineral granules are specified.
****

[Coating]

Flashings

****
NOTE: Include paragraph or bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.
****

[Asphalt]

Cold weather installation

SD-11 Closeout Submittals

Information card

Instructions to Government personnel

1.3 QUALITY ASSURANCE

1.3.1 Product Data Requirements

Submit data for the door insulation and modified Bitumen sheet as required below:

1.3.1.1 Roof Insulation Product Data Requirements

Submit all data required by Section 07220, "Roof and Deck Insulation," together with requirements of this section. Data shall include written acceptance by the roof membrane manufacturer of the insulation provided.

1.3.1.2 Modified Bitumen Sheet Product Data Requirements

Manufactures published catalog data shall include the following information for each sheet type specified. This information shall be presented in the same units of measure stated in this specification and its referenced standards. The test method for determining the following sheet requirements are found in ASTM D 5147, ASTM D 228 for Net Mass (Weight) requirements, and in ASTM D 5849 for cyclic joint displacement.

a. Dimensions and Weight

(1) Thickness
(2) Net Mass (Weight)

b. Physical and Mechanical Properties

(1) Sheet type
(2) Load strain properties
(3) Ultimate elongation (fiberglass reinforcing only)

(4) Tear strength
(5) Low temperature flexibility
(6) Dimensional stability
(7) Compound stability
(8) Granule embedment

c. Performance

(1) Cyclic joint displacement

1.3.2 Manufacturer's Instruction Requirements

Include detailed application instructions and standard drawings altered as required by these specifications for [torches,] [cold-applied adhesive,] [modified bitumen sheet,] [felts,] [primer,] [fasteners,] [coating,] [asphalt roof cement,] [flashings,] [asphalt,] and [cold weather installation]. Explicitly identify in writing, differences between manufacturer's instructions and the specified requirements.

1.3.3 CERTIFICATE REQUIREMENTS

1.3.3.1 Manufacturers Qualifications Certificates

Certify that the manufacturer of the modified bitumen membrane meets requirements specified under paragraph entitled "Qualification of Manufacturer." Show evidence that products used within this specification are manufactured in the United States. Certify that the applicator meets requirements specified under paragraph entitled "Qualification of Applicator."

1.3.3.2 Warranty Application Certificate

Provide copy of Application for Roofing Guarantee from roofing contractor and Letter of Intent to Warrant for the roofing system by the Manufacturer.

1.3.3.3 [Bill of Lading Certificate

Submit bill of lading when labels of asphalt containers do not bear the flash point (FP), finished blowing temperature (FBT), and equiviscous temperature (EVT).]

1.3.4 Closeout Submittal Requirements

Submit instructions meeting the requirements for Field Quality Control of paragraph entitled "Instructions of Government Personnel" and include copies of Material Safety Data Sheets for maintenance/repair materials. Furnish requirements as specified in paragraph entitled "Information Card" in PART 3 of this section.

1.3.5 Qualification of Manufacturer

Modified bitumen sheet roofing system manufacturer shall have a minimum of 5 years experience in manufacturing modified bitumen roofing products specified herein.

1.3.6 Qualification of Applicator

Roofing system applicator shall be approved, authorized, or licensed in writing by the modified bitumen sheet roofing system manufacturer and shall

have a minimum of three years experience as an approved, authorized, or licensed applicator with that manufacturer and be approved at a level capable of providing the specified warranty. The applicator shall supply the names and locations of 5 projects of similar size and scope that he has constructed using the manufacturer's roofing products submitted for this project within the previous three years.

1.3.7 Fire Safety

Complete roof covering assembly shall:

****
NOTE: Class A roof requires metal clad flashing with this roofing system.
****

a. Have ASTM E 108 Class 1A or UL 790, Class A classification; and

b. Be listed as part of Fire-Classified roof deck construction in UL RMSD, or Class I roof deck construction in FM P7825.

UL approved components of the roof covering assembly shall bear the UL label.

1.3.8 Wind Uplift

****
NOTE: Generally, specify Class I-90 and 4.30 kilopascals (kPa) per square meter 90 pounds per square foot (psf).
****

Complete roof covering assembly shall be rated Class I- [60] [90] in accordance with FM P7825 capable of withstanding an uplift pressure of [2.85] [4.30] kPa per square meter [60] [90] psf.

1.3.9 Preroofing Conference

After approval of submittals and before performing roofing and insulation work, including associated work, the Contracting Officer will hold a preroofing conference to review the following:

a. Drawings and specifications;

b. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roofing substrate, roof insulation, and installation of the roofing in accordance with the roof system warranty, the name of the manufacturer's technical representatives, the frequency of the onsite visits, copies of the roof status reports from the technical representatives to roof manufacturer, and pertinent structural details relating to the roofing system;

c. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing; and

d. Safety requirements.

Preroofing conference shall be attended by the designer, the Contractor and

personnel directly responsible for the installation of roofing and insulation, flashing and sheet metal work, [[mechanical] [and] [electrical] work], [Fire Marshall,] and representative of the roofing materials manufacturer. Before beginning roofing work, confirm in writing the resolution of conflicts among those attending the preroofing conference.

1.3.10 Field Samples and Tests

The Government reserves the right to sample roofing materials at random from the products delivered to the job site and test them to verify the products either conform to the referenced specifications or the approved substitution. Products which do not conform shall be removed from the job site and replaced with new products that conform to the referenced specification or the approved substitution.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

****
NOTE: Include paragraph or bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.
****

Deliver materials in manufacturers' original unopened containers and rolls with labels intact and legible. Ship modified bitumen sheet rolls stacked vertically on pallets wrapped with shrink wrap or shrink bags. Pallets to be surfaced with a continuous smooth surface to avoid damage to ends of rolls. Mark and remove wet or damaged materials from the site. Where materials are covered by a referenced specification, the container shall bear the specification number, type, and class, as applicable. [Labels or bill of lading for roofing asphalt shall indicate asphalt type, FP, FBT, and EVT, that is, the temperature at which the viscosity is either 125 centistokes when tested in accordance with ASTM D 2170 or 75 centipoise when tested in accordance with ASTM D 4402.] Deliver materials in sufficient quantity to allow work to proceed without interruption.

1.4.2 Storage

Protect materials against moisture absorption. Store roll materials on end on clean raised platforms or pallets one level high in dry locations with adequate ventilation, such as an enclosed building or closed trailer. Do not store roll materials in buildings under construction until concrete, mortar, and plaster work is finished and dry. Maintain roll materials at temperatures above 10 degrees C 50 degrees F for 24 hours immediately before application. Do not store materials outdoors unless approved by the Contracting Officer. Completely cover felts stored outdoors, on and off roof, with waterproof canvas protective covering. Do not use polyethylene sheet as a covering. Tie covering securely to pallets to make completely weatherproof and yet provide sufficient ventilation to prevent condensation. Do not store more materials on roof than can be installed the same day and remove unused materials at end of each days work. Distribute materials temporarily stored on roof to stay within live load limits of the roof construction.

1.4.3 Handling

Select and operate material handling equipment so as not to damage applied

roofing. Prevent damage to edges and ends of roll materials.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not install roofing system when air temperature is below 4 degrees C 40 degrees F, during any form of precipitation, including fog, or when there is ice, frost, moisture, or any other visible dampness on the roof deck. Provide manufacturer's printed directions for installation during cold weather conditions.

1.6 SEQUENCING

Coordinate the work with other trades to ensure that components which are to be secured to or stripped into the roofing system are available and that flashing and counter flashing are installed as the work progresses.

1.7 WARRANTY

****
NOTE: Warranty clause has been approved by NAVFACENGCOMHQ in accordance with NAVFAC P-68 and may be used without other HQ approval or request for waiver.
****

Furnish the modified bitumen sheet roofing system manufacturer's "no-dollar-limit" warranty for the roofing system, including insulation, flashing, and accessories. The warranty shall run directly to the Government. In no event shall the warranty period be less than 10 years from the date of the Government's acceptance of the work, notwithstanding roofing applicator's or manufacturer's unpaid invoices for installation, supplies, or service. The warranty shall state that:

a. When within the warranty period the roofing system becomes nonwatertight, splits, tears, blisters, or separates at the seams or shows any other evidence of excessive weathering, because of defective materials or workmanship, the repair or replacement of defective materials and correction of defective workmanship shall be the responsibility of the manufacturer;

b. When the manufacturer or the manufacturer's approved applicator fail to perform repairs within 72 hours of notification, emergency repairs performed by others will not void the warranty; and

****
NOTE: Except for projects located in the LANTNAVFACENGCOM or SOUTHNAVFACENGCOM areas or when a specially designed system capable of withstanding sustained 120 to 160 km/h 75 to 100 mph winds is to be provided, specify 90 km/h 55 mph. Specify sustained winds of 120 km/h 75 mph for LANTNAVFACENGCOM projects except those located in the Caribbean area. For projects in the Caribbean, specify 160 km/h 100 mph. Specify 160 km/h 100 mph for SOUTHNAVFACENGCOM projects.
****

c. Damage to the roofing system caused by sustained winds having a velocity of [90] [120] [160] km/h [55] [75] [100] mph or less is

covered by the warranty.

PART 2 PRODUCTS

2.1 DESCRIPTION OF ROOFING SYSTEM

****
NOTE: Delete roofing systems which do not apply. Delete inapplicable substrates.
****

2.1 Description of Roofing System

Provide roofing system as described below and capable of passing ASTM D 5849. Passing results shall show no signs of membrane cracking or interply delamination after 500 cycles at 14^{o} F -10^{o} C or 200 cycles after heat conditioning. Heat conditioning shall be in accordance to ASTM D 5147.

[2.1.2 [SBS] [APP] Modified Bitumen Sheet on Nailable Substrate

****
NOTE: A layer of insulation should be applied over wood and plywood substrates when torch grade modified bitumen sheet is specified.
****

[Substrate: [Wood] [Plywood]	
Components:	Quantity:
[Insulation	See subpara. "a" below]
Base Sheet (GB)	1 ply
Mechanical Fasteners	See subpara. "b" below
Type IV Asphalt	12.5 kg/10 sq. meters
SBS Modified Bitumen Base Sheet (MB)	1 ply
Type IV Asphalt	12.5 kg/10 sq. meters
SBS Modified Bitumen Cap Sheet (RSS)	1 ply

][Substrate: [Wood] [Plywood]

Components:	Quantity:
[Insulation	See subpara. "a" below]
Base Sheet (GB)	1 ply
Mechanical Fasteners	See subpara. "b" below
Type IV Asphalt	25 lbs/100 sq. ft.
SBS Modified Bitumen Base Sheet (MB)	1 ply
Type IV Asphalt	25 lbs/100 sq. ft.
SBS Modified Bitumen Cap Sheet (RSS)	1 ply

][Substrate: [Wood] [Plywood]

Components:	Quantity:
[Insulation	See subpara. "a" below]
Base Sheet (GB)	1 ply
Mechanical Fasteners	See subpara. "b" below
APP Modified Bitumen Sheet (RSA)	1 ply
Top Surfacing	See subpara. "c" below

]

[a. Roof insulation shall conform to the requirements specified in Section 07220, "Roof and Deck Insulation."]

[b. Quantity and spacing of fasteners shall be in conformance with modified bitumen sheet manufacturer's requirements.]

[c. If not factory-applied, protective coating shall be in conformance with modified bitumen sheet manufacturer's requirements.]

****

NOTE: Metal deck shall be covered with rigid board roof insulation to provide a surface for the modified bitumen sheet roofing. Coordinate these requirements with Section 05310, "Steel Decks," to ensure that metal deck is a minimum 0.8 mm 22 gage thick.

****

[Substrate: Metal Deck

Components:	Quantity:
Insulation	See subpara. "a" below
Base Sheet (GB)(As required by manufacturer)	1 ply
Mechanical Fasteners	5 per sq. meter
Type IV Asphalt	12.5 kg/10 sq. meters
SBS Modified Bitumen Sheet (MB)	1 ply
Type IV Asphalt	12.5 kg/10 sq. meters
SBS Modified Bitumen Cap Sheet (RRS)	1 ply

][Substrate: Metal Deck

Components:	Quantity:
Insulation	See subpara. "a" below
Base Sheet	1 ply
Mechanical Fasteners	1 per 2 sq. ft.
Type IV Asphalt	25 lbs/100 sq. ft.
SBS Modified Bitumen Base Sheet (MB)	1 ply
Type IV Asphalt	25 lbs/100 sq. ft.
SBS Modified Bitumen Cap Sheet (RSS)	1 ply

][Substrate: Metal Deck

Components:	Quantity:
Insulation	See subpara. "a" below
Type IV Asphalt	See subpara. "b" below
Base Sheet (GB)	1 ply
Mechanical Fasteners	5 per sq. meter
APP Modified Bitumen Sheet (RSA)	1 ply
Top Surfacing	See subpara. "c" below

][Substrate: Metal Deck

Components:	Quantity:
Insulation	See subpara. "a" below
Type IV Asphalt	See subpara. "b" below
Base Sheet (GB)	1 ply
Mechanical Fasteners	1 per 2 sq. ft.
APP Modified Bitumen Sheet (RSA)	1 ply
Top Surfacing	See subpara. "c" below

][Substrate: Metal Deck

Components:	Quantity:
Insulation	See subpara. "a" below
Cold-Applied Adhesive	3.78 liters/6 sq. meters
SBS Modified Bitumen Sheet (MB)	1 ply
Cold-Applied Adhesive	3.78 liters/6 sq. meters
SBS Modified Bitumen Cap Sheet (RRS)	1 ply

][Substrate: Metal Deck

Components:	Quantity:
Insulation	See subpara. "a" below
Cold-Applied Adhesive	1 gal/65 sq.ft
SBS Modified Bitumen Sheet (MB)	1 ply
Cold-Applied Adhesive	1 gal/65 sq.ft
SBS Modified Bitumen Cap Sheet (RRS)	1 ply

]

[a. Roof insulation shall conform to the requirements specified in Section 07220, "Roof and Deck Insulation."]

[b. Quantity of asphalt shall be in accordance with modified bitumen sheet manufacturer's requirements.]

****

NOTE: Include subparagraph c when cold-applied

adhesive method is used.

****

[c. The quantity of adhesive at application may require heavier applications than specified above to ensure adhesion. Apply in accordance with modified bitumen sheet manufacturer's requirements.]

[d. If not factory-applied, protective coating shall be in conformance with modified bitumen sheet manufacturer's requirements.]

][2.1.3 [APP] [SBS] Modified Bitumen Sheet on Non-Nailable Substrate

****

NOTE: Include one or both of these system descriptions, as applicable, when roofing membrane is applied directly to substrate and not over roof insulation.

****

[Substrate: Poured-in-Place Concrete

Components:	Quantity:
Asphalt Primer	3 liters/10 sq. meters
Type IV Asphalt	Spot-mop
Ventilating Base Sheet (VB)	1 ply
APP Modified Bitumen Sheet (RSA)	1 ply
Top Surfacing	See subpara. "a" below

][Substrate: Poured-in-Place Concrete

Components:	Quantity:
Asphalt Primer	3/4 gal/100 sq.ft.
Type IV Asphalt	Spot-mop
Ventilating Base Sheet (VB)	1 ply
APP Modified Bitumen Sheet (RSA)	1 ply
Top Surfacing	See subpara. "a" below

a. If not factory-applied, protective coating shall be in conformance with modified bitumen sheet manufacturer's requirements.

][Substrate: Poured-in-Place Concrete

Components:	Quantity:
Asphalt Primer	3 liters/10 sq. meters
Type IV Asphalt	12.5 kg/10 sq. meters
Base Sheet (GB)	1 ply
Type IV Asphalt	12.5 kg/10 sq. meters
SBS Modified Base Sheet (MB)	1 ply
Type IV Asphalt	12.5 kg/10 sq. meters
SBS Modified Bitumen Cap Sheet (RSS)	1 ply

][Substrate: Poured-in-Place Concrete

Components:	Quantity:

][Substrate: Poured-in-Place Concrete

Components:	Quantity:
Asphalt Primer	3/4 gal/100 sq. ft.
Type IV Asphalt	25 lbs/100 sq. ft.
Base Sheet (GB)	1 ply
Type IV Asphalt	25 lbs/100 sq. ft.
SBS Modified Base Sheet (MB)	1 ply
Type IV Asphalt	25 lbs/100 sq. ft.
SBS Modified Bitumen Cap Sheet (RSS)	1 ply

****

NOTE: The following cold-applied adhesive system is not intended for use on lightweight insulated, concrete roof decks.

****

][Substrate: Poured-in-Place Concrete

Components:	Quantity:
Asphalt Primer	3 liters/10 sq. meters
Asphalt coated Base Sheet (GVB)	1 ply applied dry
Cold-applied adhesive	3.78 liters/6 sq. meters
SBS Modified Base Sheet (MB)	1 ply
Cold-applied adhesive	3.78 liters/6 sq. meters
SBS Modified Bitumen Cap Sheet (RSS)	1 ply

][Substrate: Poured-in-Place Concrete

Components:	Quantity:
Asphalt Primer	3/4 gal/100 sq. ft.
Asphalt coated Base Sheet (GVB)	1 ply applied dry
Cold-applied adhesive	1 gal/65 sq. ft.
SBS Modified Base Sheet (MB)	1 ply
Cold-applied adhesive	1 gal/65 sq. ft.
SBS Modified Bitumen Cap Sheet (RSS)	1 ply

]

]2.2 MATERIALS

[2.2.1 Asphalt

****

NOTE: Include paragraph or bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.

Include requirements for temporary roofing and

flashing when construction will require considerable work on roof, such as, installing cooling towers, antennas, pipes, ducts, solar collectors, or other equipment, and temporary roofing is considered necessary to ensure that permanent roofing is not damaged during construction.

****

ASTM D 312, Type IV.

]2.2.2 Modified Bitumen Sheet, Felts

Provide all field sheets of the roofing membrane with the same type reinforcing material.

****

NOTE: Delete roofing sheet materials which are not applicable to the roofing system specified in paragraph entitled "Description of Roofing System."

****

****

NOTE: Use Grade G for SBS bitumen cap sheet (RSS) unless the design will utilize a coating or field broadcasted aggregate for weather protection, which can utilize Grade S cap sheet.

****

Designation	Use	Felt-Type	Impregnant	Coating	Specification
GVB	Base Sheet	Glass	Asphalt	Asphalt	With 38 mm1.5 in. diameter perforations (spot bonded)
GB	Base Sheet	Glass	Asphalt	Asphalt	ASTM D 4601, Type II, without perforations
VB	Ventilating Base Sheet	Glass	Modified Bitumen	Modified Bitumen	ASTM D 4897 Type II
MB	SBS Modified Base Sheet	Fiber-glass or Poly-ester or combined fiberglass polyester	SBS Modified Bitumen	SBS Modified Bitumen	ASTM D 6162, Grade S, and as modified in subparagraph "a" below ASTM D 6163, Grade S, and as modified in subpara. "b" below ASTM D 6164, Grade S, and as modified in subpara. "c"

Designation	Use	Felt-Type	Impregnant	Coating	Specification
					below
RSS	SBS Bitumen Cap Sheet Roofing Fire rated	Fiber-glass or Poly-ester or combined fiberglass polyester	SBS Modified Bitumen	SBS Bitumen Granules	ASTM D 6162, Grade G [or S], and as modified in subpara. "a" below ASTM D 6163, Grade G [or S], and as modified in subpara. "b" below ASTM D 6164, Grade G [or S], and as modified in subpara. "c" below
FS	Flashing Sheet Fire rated	Fiber glass	SBS Modified Bitumen	SBS Metal Clad	ASTM D 6298
RSA	APP Modified Sheet Roofing		APP Modified Bitumen	APP Modified Bitumen	See subpara. "d" below

a. ASTM D 6162 Modifications (Combined Polyester and Glass Fiber Reinforcing)

(1) "6. Physical Properties." Modify paragraph 6.1 by deleting the ASTM Physical property values from reference Table 2, that are in conflict with this specification note. The physical property values listed below supersede that ASTM requirement.

TABLE 2 Physical Properties of SBS Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements

Property	Type I Grade: G and S	Type II Grade: G and S
Low Temperature Flexibility, Max Before and After Heat Conditioning ^{o}F $^{o}(C)$	-5(-20)	-5(-20)

(2) "7. Dimensions, Mass, and Permissible Values" Modify paragraph 7.2 by deleting the ASTM dimensions and masses from reference Table 1, that are in conflict with this specification note. The dimension and mass values listed below supersede the

ASTM requirement.

****

NOTE: For LANTNAVFACENGCOM projects in Iceland, delete the Grade G (cap) sheet thickness and mass/unit area in the following paragraph and insert in their place 180 mil (4.6 mm) minimum thickness and 145 pounds per 100 sq. ft. (7079g/M^2) minimum mass/unit area.

****

TABLE 1 Dimensions and Masses of SBS Modified Bituminous Sheet Materials Using A Combination of Polyester and Glass Fiber Reinforcements

Description	Type 1	Type II
Thickness, min, mils (mm)		
Grade S	85 (2.2)	85 (2.2)
Grade G	130 (3.3)	130 (3.3)
Grade G (Selvage Edge)	95 (2.4)	95 (2.4)
Net mass unit area, min lbs/100 ft 2, (g/m2)		
Grade S	58 (2831)	58 (2831)
Grade G	90 (4394)	90 (4394)

(3) "8. Workmanship, Finish and Appearance" Modify paragraph 8.2 by adding the following sentence to the end of the paragraph. Granules shall completely obstruct the view of the SBS modified bituminous coating substrate. Three 305x 610 mm 12x24 inch samples shall be taken from three different rolls of roofing materials delivered to the site and observed with the naked eye with daylighting at a distance a 915 mm 3 feet."

b. ASTM D 6163 Modifications (Glass Fiber Reinforcing)

(1) "6. Physical Properties." Modify paragraph 6.1 by deleting the ASTM Physical property values from reference Table 2, that are in conflict with this specification note. The physical property values listed below supersede that ASTM requirement.

TABLE 2 Physical Properties of SBS Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements

Property	Type I Grade: G and S	Type II Grade: G and S
Elongation (ultimate) at 5% of maximum load 73.4 +/- 3.6 degrees F (23 +/- 2 degrees C), MD and XMD, min. (%)		
as manufactured:	26	40
after heat conditioning:	15	20
Compound stability at	no failures	no failures

TABLE 2 Physical Properties of SBS Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements

225 degrees F (107 degrees C)

(2) "7. Dimensions, Mass and Permissible Variations." Modify paragraph 7.2 by deleting the ASTM dimensions and masses from reference Table 1, that are in conflict with this specification note. The dimension and mass values listed below supersede the ASTM requirement.

****

NOTE: For LANTNAVFACENGCOM projects in Iceland, delete the Grade G (cap) sheet thickness and mass/unit area in the following paragraph and insert in their place 180 mil (4.6 mm) minimum thickness and 145 pounds per 100 sq. ft. (7079g/M^2) minimum mass/unit area.

****

TABLE 1 Dimensions and Masses of SBS Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements

Description	Type I	Type II
Thickness, min, mils (mm),		
Grade S	85 (2.2)	85 (2.2)
Grade G	130 (3.3)	130 (3.3)
Grade G (Selvage Edge)	95 (2.4)	95 (2.4)
Net mass/unit area, min, lbs/ft 2 (g/m 2)		
Grade S	58 (2831)	58 (2831)
Grade G	90 (4394)	90 (4394)

(3) "8. Workmanship, Finish and Appearance" Modify paragraph 8.2 by adding the following sentence to the end of the paragraph. Granules shall completely obstruct the view of the SBS modified bituminous coating substrate. Three 305x 610 mm 12x24 inch samples shall be taken from three different rolls of roofing materials delivered to the site and observed with the naked eye with daylighting at a distance a 915 mm 3 feet."

c. ASTM D 6164 Modifications (Polyester Reinforcing)

(1) "6. Physical Properties." Modify paragraph 6.1 by deleting the ASTM physical properties values from reference Table 2, that are in conflict with this specification note. The physical property values listed below supersede that ASTM requirements.

TABLE 2 Physical Properties of SBS Modified Bituminous Sheet Materials Using Polyester Reinforcements

	Type I	Type II

TABLE 2 Physical Properties of SBS Modified Bituminous Sheet Materials Using Polyester Reinforcements

Property	Grade: G and S	Grade: G and S
Dimensional stability, max (%)	.5	.5
Compound stability at 225^{o}F (107^{o} C)	no failures	no failures
Low Temperature Flexibility, Max. Before and After Heat Conditioning ^{o}F (^{o}C)	-5(-20)	-5(-20)

(2) "7. Dimensions Mass, and Permissible Values" modify paragraph 7.2 by deleting the ASTM dimensions and masses from reference Table 1, that are in conflict with this specification note. The dimension and mass values listed below supersede the ASTM requirements.

****

NOTE: For LANTNAVFACENGCOM projects in Iceland, delete the Grade G (cap) sheet thickness and mass/unit area in the following paragraph and insert in their place 180 mil (4.6 mm) minimum thickness and 145 pounds per 100 sq. ft. (7079g/M^2) minimum mass/unit area

****

TABLE 1 Dimensions and Masses of SBS Modified Bituminous Sheet Materials Using Polyester Reinforcements

Description	Type I	Type II
Thickness, min, mils (mm),		
Grade S	85 (2.2)	115 (2.9)
Grade G	130 (3.3)	130 (3.3)
Grade G (Selvage Edge)	95 (2.4)	120 (3.0)
Net mass/unit area, min, lbs/100 ft^2(g/m^2)		
Grade S	58 (2831)	70 (3417)
Grade G	90 (4394)	90 (4394)

(3) "8. Workmanship, Finish and Appearance" Modify paragraph 8.2 by adding the following sentence to the end of the paragraph. Granules shall completely obstruct the view of the SBS modified bituminous coating substrate. Three 305x 610 mm 12x24 inch samples shall be taken from three different rolls of roofing materials delivered to the site and observed with the naked eye with daylighting at a distance a 915 mm 3 feet."

d. Modified bitumen sheet shall be a prefabricated atactic polypropylene (APP) modified bitumen sheet, 3.8 mm 150 mil thick minimum, weighing 44 kg/10 sq. meters 88 pounds per 100 sq. ft. minimum, monolithic polymer modified matrix containing bitumen,

polypropylene, and other resins, with a layer of fiberglass and/or polyester sheet reinforcement. The membrane shall contain a built-in adhesive on the underside so that the membrane and lapped joints are capable of being tack-applied.

2.2.3 Top Surfacing

****

NOTE: Coordinate surfacing requirements with the type of system specified in paragraph entitled "Description of Roofing System." Factory-applied granule surfacing should be used. Delete bracketed paragraphs below for protective coating and gravel if granules are specified.

****

Protect modified bitumen roofing system from direct exposure to the weather with one of the following surfacings as recommended by the modified bitumen roofing system manufacturer.

2.2.3.1 Mineral Roofing Granules

Factory applied, requiring no further coating.

[2.2.3.2 Protective Coating

The membrane manufacturer's standard protective coating applied in accordance with the roofing membrane manufacturer's printed application instructions.

][2.2.3.3 Gravel

Aggregate surfacing material conforming to ASTM D 1863, sized and of the quantity recommended by the modified bitumen roofing system manufacturer.

][2.2.4 Primer

ASTM D 41.

]2.2.5 Asphalt Roof Cement

ASTM D 4586, Type II for vertical surfaces, Type I for horizontal surfaces.

2.2.6 Cold-Applied Adhesive

Cold application adhesive shall be made from special adhesive asphalts, quick-drying solvents and meet requirements of ASTM D 4479, Type II.

2.2.6 Fasteners

Provide noncorrosive fasteners as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of FM A/S4470. For felts, provide fasteners driven through metal discs, or one piece composite fasteners with heads not less than 25 mm one inch in diameter or 25 mm one inch square with rounded or 45 degree tapered corners.

2.2.6.1 [Masonry] [or] [Concrete] Walls and Vertical Surfaces

Provide hardened steel nails with flat heads, diamond shaped points, and mechanically deformed shanks not less than 25 mm one inch long for securing felts, modified bitumen sheets, and metal Items to [masonry] [or] [concrete] walls and vertical surfaces. Use power-driven fasteners only when approved in writing.

2.2.7 Metal Discs (Tin Caps)

Flat noncorrosive fasteners as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of FM A/S4470; not less than 75 mm 3 inches in diameter, when using screw type fasteners. Discs shall be formed to prevent dishing or cupping.

[2.2.8 Moisture Release Vents

****
NOTE: Do not include this paragraph for projects in the SOUTHNAVFACENGCOM area.

Venting of roof insulation is advisable when vapor retarder is provided beneath insulation. The vapor retarder should be specified in Section 07220, "Roof and Deck Insulation." Coordinate with Section 06100, "Rough Carpentry," to ensure that kerfed wood nailers are specified at edge of roof insulation and placed around periphery. For roofs more than 12000 mm 40 feet wide, stack venting should be provided to supplement edge venting. Underside ventilation for steel decks should consist of continuous openings 3 to 5 mm 1/8 to 3/16 inch wide between adjacent deck units. Coordinate these requirements with appropriate specification sections.
****

Vents shall be especially manufactured for the purpose of releasing moisture and vapor from the roofing system by heat and pressure. Vents shall be one-way type design to prevent reverse flow of moisture laden air into roofing system. Valve cap shall effectively seal out wind-blown rain and snow and shall not permit water entry if submerged.

][2.2.9 Precast Paver Blocks and Walkboards

****
NOTE: Use concrete pavers or walkboards as walkways where the roof or areas of the roof are intended to bear foot traffic for maintenance or other purposes once a month or more frequently.
****

Roof walkways shall be smooth-surfaced precast concrete paver blocks, reprocessed rubber, minimum 13 mm 1/2 inch thick, or walkboards compatible with the modified bitumen sheet roofing and as recommended by the modified bitumen sheet roofing manufacturer.

]2.2.10 Roof Insulation Below Modified Bitumen Membrane System

****
NOTE: If the roofing system contains insulation, coordinate with the appropriate insulation

specification section. The insulation specification should include materials and installation up to the substrate on which the base sheet and or membrane is to be installed. Coordinate base sheet attachment (mechanically fastened or mopped) with FM or UL fire and wind uplift requirements.

****

Insulation shall be compatible with the membrane as recommended in modified bitumen manufacturer's printed instructions [and as specified in Section 07220, "Roof and Deck Insulation"].

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

Ensure that the following conditions exist prior to application of the roofing materials:

****

NOTE: Expansion joints should be at least 25 mm one inch thick and should be made of material that will compress to one-half its original thickness under a stress of 175 kPa 25 psi. Coordinate these requirements with the appropriate specifications section.

****

a. [Drains,] [curbs,] [cants,] [control joints,] [expansion joints,] [perimeter walls,] [roof penetrating components,] [and] [equipment supports] are in place.

b. Surfaces are rigid, dry, smooth, and free from cracks, holes, and sharp changes in elevation. Joints in the substrate are sealed to prevent dripping of bitumen into building or down exterior walls.

c. The plane of the substrate does not vary more than 6 mm 1/4 inch within an area 3 by 3 meters 10 by 10 feet when checked with a 3 meter 10 foot straight edge placed anywhere on the substrate.

d. Substrate is sloped as indicated to provide positive drainage.

e. Walls and vertical surfaces are constructed to receive counter flashing, and will permit nailing of the base flashing materials.

****

NOTE: Coordinate with Section 06100, "Rough Carpentry," to ensure that waterborne preservative treatment is specified for wood which will be in contact with roofing components.

****

f. Treated wood nailers are fastened in place at eaves, gable ends, openings, and intersections with vertical surfaces for securing of felts, edging strips, gravel stops, and roof fixtures. [Embedded nailers are flush with deck surfaces.] [Surface-applied nailers are the same thickness as the roof insulation.]

****

NOTE: Use wood cant in non-supported flashing and wood blocking details (expansion joints, area dividers, and wall/roof intersections where roof deck is not supported by a wall).

****

g. Cants are securely fastened in place in the angles formed by walls and other vertical surfaces. The angle of the cant is 45 degrees and the height of the vertical leg is not less than nominal 100 mm 4 inches. Cants are constructed of [treated wood] [wood fiberboard roof insulation].

h. Venting is provided in accordance with the following:

(1) [Edge Venting: Perimeter nailers are kerfed across the width of the nailers to permit escape of gaseous pressure at roof edges.]

(2) [Underside Venting: Vent openings are provided in steel form decking for cast-in-place concrete substrate.]

****

NOTE: Do not include this paragraph for projects in the SOUTHNAVFACENGCOM area.

****

(3) [Moisture release vents: Holes equal to the outside diameter of vents are provided through the insulation where vents are required.]

i. [Insulation boards are installed smoothly and evenly, and are not broken, cracked, or curled. Insulation is being roofed over on the same day the insulation is installed.]

j. [Cast-in-place substrates have been allowed to cure and the surface dryness requirements specified under paragraph entitled "Field Quality Control" have been met.]

k. [Joints between precast concrete deck units are grouted and leveled.]

3.2 PREPARATION

3.2.1 Protection of Property

3.2.1.1 Protective Coverings

****

NOTE: Include paragraph or bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.

****

Install protective coverings at paving and building walls adjacent to hoist [and kettles] prior to starting the work. Lap protective coverings not less than 150 mm six inches, secure against wind, and vent to prevent collection of moisture on covered surfaces. Keep protective coverings in place for the duration of the roofing work.

[3.2.1.2 Flame-Heated Equipment

****
NOTE: Include paragraph or bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.
****

Do not place flame-heated equipment on roof. Provide and maintain a fire extinguisher adjacent to flame-heated equipment and on the roof.

][3.2.1.3 Open Flame Application Equipment

****
NOTE: Include this requirement when APP modified bitumen sheet roofing is specified in paragraph entitled "Description of Roofing System."
****

Torches and other open flame equipment shall be specifically designated for use in application of modified bitumen and approved by the modified bitumen sheet manufacturer. Open flame equipment shall not be ignited (burning) when left unattended. Provide and maintain a fire extinguisher adjacent to open flame equipment on the roof. [Apply a base sheet, in accordance with modified bitumen sheet manufacturer's recommendations, to combustible substrates prior to torch-application of modified bitumen membrane.] [Specific requirements for fire watches and burn permits exist. These requirements will be outlined at the preroofing conference.]

]3.2.1.4 Electric-Heated Equipment

Provide adequate electrical service as required by manufacturer of electrical equipment to ensure against damage to equipment and property and to ensure proper application of roofing materials.

3.2.2 Priming of Surfaces

Prime surfaces at the rate of 3 liters per 10 sq. meters 0.75 gallon per 100 sq. ft. or as recommended by modified bitumen sheet manufacturer's printed instructions and allow to dry.

[3.2.2.1 Priming of Concrete and Masonry Surfaces

****
NOTE: Include this paragraph when roofing and flashing are applied directly to concrete or masonry surfaces.
****

After surface dryness requirements have been met, coat concrete and masonry surfaces which are to receive base sheet and roofing materials uniformly with asphalt primer. Allow primer to dry prior to application of base sheet, roofing, and [temporary roofing,] flashing.

]3.2.2.2 Priming of Metal Surfaces

Prime flanges of metal edging strips, prior to stripping into roofing system in accordance with modified bitumen manufacturer's printed instructions and allow to dry.

[3.2.3 Heating of Asphalt

****
NOTE: Include paragraph or bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.
****

Break up solid asphalt on a surface free of dirt and debris. Heat asphalt in kettle designed to prevent contact of flame with surfaces in contact with the asphalt. Kettles shall have visible thermometer and thermostatic controls set to the temperature limits specified herein. Keep controls in working order and calibrated. Use immersion thermometer, accurate within a tolerance of plus or minus one degree C 2 degrees F, to check temperatures of the asphalt frequently. When temperatures exceed maximums specified, remove asphalt from the site. Do no permit cutting back, adulterating, or fluxing of asphalt.

]3.3 APPLICATION

Apply roofing materials as specified herein unless specified or recommended otherwise by manufacturer's printed application instructions and approved by the Contracting Officer. Keep roofing materials dry before and during application. Do not permit phased construction. Complete application of roofing in a continuous operation. Begin and apply only as much roofing in one day as can be completed that same day. Maintain specified temperatures for asphalt. Modified Bitumen Base Sheet shall not remain exposed prior to application of the Modified Bitumen Cap Sheet unless approved by the Contracting Officer and supported by the manufacturer's standard written application instructions. [Provide temporary roofing and flashing as specified herein prior to application of permanent roofing system.]

[3.3.1 Temporary Roofing and Flashing

****
NOTE: Include requirements for temporary roofing and flashing when construction will require considerable work on roof, such as, installing cooling towers, antennas, pipes, ducts, solar collectors, or other equipment, and temporary roofing is considered necessary to ensure that permanent roofing is not damaged during construction.
****

Provide temporary roofing and flashing where considerable work by other trades, such as installing [cooling towers,] [antennas,] [pipes,] [ducts,] [_____,] is to be performed on the roof or where construction scheduling or weather conditions require protection of the building's interior before permanent roofing system can be installed. Do not install temporary roofing over permanently installed insulation. Provide rigid pads for traffic over temporary roofing.

][3.3.1.1 Temporary Roofing Membrane

Install 2 plies of ASTM D 2178, Type IV fiberglass felts with ASTM D 312, Type IV asphalt in accordance with the application procedures specified [; except spot mop the first ply on cast-in-place concrete decks by brooming felts into 300 mm 12 inch diameter spots of asphalt spaced 450 mm 18 inches o.c].

][3.3.1.2 Temporary Flashing

Install temporary flashing consisting of one ply of ply felt. Place ply felt in a trowel coat of asphalt roof cement and cover with a trowel coat of asphalt roof cement.

][3.3.1.3 Removal

Completely remove temporary roofing and flashing before continuing with application of the permanent roofing system.

][3.3.2 Bitumen Stops

****
NOTE: Include paragraph or bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.
****

Provide bitumen stops at roof edges, openings, and vertical projections before hot mopped application of the roofing membrane (base sheet and modified bitumen). Do not provide sheet metal bitumen stops. Form bitumen stops of two 450 mm 18 inch wide strips of organic felt conforming to ASTM D 226. ply felts. Attach 225 mm nine inches of the width to the roof surface and extend 225 mm 9 inches beyond the edge. Apply first strip in a 225 mm 9 inch wide layer of asphalt roof cement and, where nailers are provided, nail on 150 mm 6 inch spacing 13 mm 1/2 inch from the edge. Apply second strip in a 225 mm 9 inch wide mopping of asphalt. Protect the free portion of each strip from damage throughout the roofing period. After the roofing plies are in place, fold the free portion of each strip over the roofing membrane and embed in a continuous coating of asphalt roof cement and secure with fasteners 75 mm 3 inches o.c.

][3.3.3 Ventilating Base Sheets

****
NOTE: Include this paragraph when ventilating base sheets are specified in the paragraph entitled "Description of Roofing System."
****

Apply ventilating base sheets in accordance with manufacturer's printed application instructions.

][3.3.4 Glass Vented Base, SBS Base and Cap Sheets

****
NOTE: Include this paragraph when cold-applied adhesive method is used to apply SBS two-ply modified membrane sheets are applied over poured-in-place concrete roof deck.
****

Apply one ply of glass vented base sheet dry over primed concrete surfaces. Side and end laps shall be a maximum of 25 mm1 inch. Beginning at the low point of the roof, apply one ply of SBS base sheet in a full coating of cold-applied adhesive. Sides and end laps shall be at a minimum of 76 mm3 inches. Offset end laps at a minimum of 914 mm3 feet. SBS base sheet

shall be rolled after application to ensure complete contact with the adhesive. Beginning again at the low point of the roof, apply one ply of SBS modified membrane cap sheet in a full coating of cold-applied adhesive over the previously applied SBS base sheet. Side and end laps shall be a minimum of 76 mm3 inches. Off set end laps a minimum of 914 mm3 feet and stagger laps between plies. SBS cap sheet shall be rolled after application to ensure complete contact with the adhesive. Apply matching roof granules to lap seams with adhesive that is forced out during rolling.

]3.3.4 Base Sheet

****
NOTE: Delete first bracketed requirement and include second where base sheet is applied to nailable substrate. Apply felts at right angles to roof slope, except on insulated roofs where nailers (insulation stops) have been applied at right angles to slope and on decks sloped one in 12 one inch per foot or more, apply felts parallel to roof slope. Include requirements for applying felts to barrel-type roofs when applicable.
****

Apply base sheets in shingle fashion [in hot mopping of asphalt]. [On nailable substrates, mechanically fasten base sheet in conformance with FM requirements and membrane manufacturer's printed instructions. Where applicable, base sheet may be mechanically fastened in conjunction with insulation to the substrate, in accordance with membrane manufacturers printed instructions.] Apply sheets in a continuous operation. Apply sheets with side laps at a minimum of 50 mm 2 inches unless greater side lap is recommended by the manufacturer's standard written application instructions. Provide end laps of not less than 150 mm 6 inches and staggered a minimum of 900 mm 36 inches. Apply sheets [at right angles to the roof slope so that the direction of water flow is over and not against the laps] [parallel to the roof slope so that prevailing winds are over and not against the laps] [so that plies of sheets extend from eave line on one side of the barrel-type roof and 450 mm 18 inches over the center line of the crown of the roof. Apply sheets on the other side in the same manner, resulting in twice the normal amount of roofing sheets and asphalt at the crown]. Extend sheets approximately 50 mm 2 inches above the top of cant strips at vertical surfaces and to the top of cant strips elsewhere. Trim felt to a neat fit around vent pipes, roof drains, and other projections through the roof. Application shall be free of ridges, wrinkles, and buckles.

[3.3.5 Hot-Mopping of Base Sheets

****
NOTE: Include paragraph or bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.
****

Provide hot asphalt for embedding of base sheets [, including modified bitumen base sheet,] to the [insulation] [substrate]. Apply base sheets immediately following application of hot asphalt. Do not work ahead with asphalt. Asphalt shall be completely fluid, with mop temperatures within the specified EVT range, at the instant base sheets come into contact with asphalt. Application of bitumen between plies shall be such as to provide

full, continuous, uniform coverage and complete penetration of asphalt into the sheet above and below. Embed sheets in asphalt. As sheets are being rolled into hot asphalt, immediately and thoroughly squeegee, roll, or broom down to eliminate trapped air and to provide tight, smooth laminations without wrinkles, buckles, kinks, and fish mouths. Completed system shall be free of air pockets and blisters.

][3.3.5.1 Temperature Limitations for Asphalt

****
NOTE: Include paragraph or bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.
****

Heat and apply asphalt at the temperatures specified below unless specified otherwise by manufacturer's printed application instructions. Use thermometer to check temperature during heating and application. Have kettle attended constantly during heating process to ensure specified temperatures are maintained. Do not heat asphalt above its FBT. Do not heat asphalt between 260 and 274 degrees C 500 and 525 degrees F for longer than four consecutive hours. Do not heat asphalt to the flash point (FP). Apply asphalt and embed base sheets when temperature of asphalt is within plus or minus 14 degrees C 25 degrees F of the equiviscous temperature (EVT). Before heating and application of asphalt refer to the asphalt manufacturer's label or bill of lading for FP, FBT, and EVT of the asphalt used.

]3.3.6 Modified Bitumen Sheets

Sheets shall be watertight and visually free of pinholes, particles of foreign matter, undispersed raw material, or other manufacturing defects that might affect serviceability. Edges of seams shall be straight and flat so that they may be seamed to one another without forming fish mouths or wrinkles.

[3.3.6.1 APP Modified Bitumen Sheets

****
NOTE: Include this paragraph when APP modified bitumen sheet roofing is specified in paragraph entitled "Description of Roofing System."
****

Torch-on or electric heat-apply fully adhered sheets. Unroll sheets, set in place with 75 mm 3 inch side laps and 150 mm 6 inch end laps. Apply heat to underside of roll and 75 mm 3 inch side lap of preceding roll and fully adhere membrane to the substrate by unrolling the heated portion of the roll onto the substrate. Ensure a minimum flow of modified bitumen of at least 10 mm 3/8 inch, not to exceed 25 mm one inch, on side and end laps as the membrane is rolled forward and adhered to the substrate. Care shall be taken so as not to overheat the top surface of the roll. After membrane has been adhered to substrate, check laps with a hot trowel to ensure laps are fully adhered. At areas where full adhesion of the laps are not obtained, reheat and trowel into place so that adhesion of the entire lap is accomplished.

][3.3.6.2 SBS Modified Bitumen Sheets

****
NOTE: Include this paragraph when SBS modified bitumen sheet roofing is specified in paragraph entitled "Description of Roofing System."
****

Solid mop top surface of base sheet with hot asphalt at the rate of 12.5 kg/10 sq. meter 25 pounds per 100 sq. ft. and embed one layer of roofing membrane into hot asphalt. Roll modified bitumen roofing membrane into place with a flow of hot asphalt out of side and end laps. Side laps shall be 100 mm 4 inches and end laps shall be 150 mm 6 inches or as recommended by the manufacturer. Stagger end laps a minimum of 900 mm 36 inches. Back mop end laps. Apply roofing in a continuous application. Start installation at the low point of the roof and progress to the high point. Provide tight, smooth laminations without wrinkles, ridges, buckles, kinks, and fishmouths. Completed system shall be free of air pockets, blisters, ridges, fishmouths, and open laps.

]3.3.7 Flashings

Apply metal clad modified bitumen sheet flashing in the angles formed where the roof deck abuts walls, curbs, ventilators, pipes, and other vertical surfaces, in accordance with membrane manufacturer's printed application instructions and where necessary to make the work watertight. Metal flashing collars and cap flashings are specified under Section 07600, "Flashing and Sheet Metal." Do not set metal flashing in hot asphalt.

[3.3.7.1 Flashing at Roof Drain

****
NOTE: Include this paragraph when interior roof drains are indicated.
****

Roof drains are specified under Section 15400, "Plumbing Systems." Flashing for roof drains, are specified under Section 07600, "Flashing and Sheet Metal." Extend [base sheet and] modified bitumen sheets to edge of drain bowl opening at the roof drain deck flange in accordance with membrane manufacturer's printed application instructions. Securely clamp base sheet, modified bitumen sheets, and metal roof drain flashing and strip flashing in the flashing clamping ring. Secure clamps so that sheets and metal flashing are free from wrinkles and folds.

]3.3.8 Roof Walkways

Install precast concrete paver block or asphalt plank roof walkways, where indicated, for traffic areas and for access to mechanical equipment, in accordance with the modified bitumen sheet roofing manufacturer's printed instructions. Provide an additional cap sheet under precast concrete paver blocks to protect the roofing.

[3.3.9 Moisture Release Vents

Set vents in a uniform pattern and at a minimum rate of one for each 100 square meters 1000 square feet of roof area. Install in strict accordance with manufacturer's instructions.

]3.3.10 Fire Watch

Provide fire watch during torch application and continue for one hour after completion of torch application. Provide at least two 10 liter 2 1/2 gallon containers of water and two 7 kg 15 pound CO2 extinguishers for use during the fire watch.

3.3.11 Clean Up

Remove debris, scraps, containers and other rubbish and trash resulting from installation of the roofing system from job site each day.

3.3.12 Protection of Applied Roofing Against Moisture Absorption

At the end of the day's work and when precipitation is imminent, protect applied modified bitumen roofing system as follows.

[3.3.12.1 Water Cutoffs

****
NOTE: Include this paragraph when roof insulation is a substrate for the modified bitumen sheet roofing.
****

Straighten insulation line using loose-laid cut insulation sheets and seal the terminated edge of modified bitumen roofing system with two full width strips of roofing felt set in and coated with asphalt roof cement. One-half width of the strips shall extend up and over the finished roofing and the other half-width extended out onto the bare deck unless recommended otherwise in membrane manufacturer's printed application instructions. [Seal off flutes in metal decking along the cutoff edge.] Pull membrane free or cut to expose the insulation when resuming work, and remove the insulation sheets used for fill-in.

]3.3.12.2 Temporary Flashing for Permanent Roofing

Provide temporary flashing at drains, curbs, walls and other penetrations and terminations of roofing sheets until permanent flashings can be applied. Temporary flashings shall consist of one ply of ply felt applied in a trowel coat of asphalt roof cement applied to a primed surface, and finished with a surface coat of asphalt roof cement. Remove temporary flashing before applying permanent flashing.

3.3.12.3 Temporary Walkways, Runways, and Platforms

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to indicated live load limits of roof construction. Use rubber-tired equipment for roofing work.

3.4 FIELD QUALITY CONTROL

Perform field tests in the presence of the Contracting Officer. Notify the Contracting Officer one day before performing tests.

[3.4.1 Test for Surface Dryness

****

NOTE: Include paragraph or bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.

****

Before application of base sheets and starting work on the area to be roofed, perform test for surface dryness in accordance with the following:

a. Foaming: When poured on the surface to which felts are to be applied, one pint of asphalt when heated in the range of 176 to 204 degrees C 350 to 400 degrees F, shall not foam upon contact.

b. Strippability: After asphalt used in the foaming test application has cooled to ambient temperatures, test coating for adherence. Should a portion of the sample be readily stripped clean from the surface, do not consider the surface to be dry and do not start application. Should rain occur during application, stop work and do not resume until surface has been tested by the method above and found dry.

][3.4.2 Roof Drain Test

****

NOTE: Include this paragraph when interior roof drains are indicated. Consult with structural engineer to verify loading capability of roof structural system. Include bracketed requirements where secondary or overflow drains are provided.

****

After completing roofing but prior to Government acceptance, perform the following test for watertightness. Plug [primary] roof drains and fill with water to edge of drain sump for 24 hours. [Do not plug secondary overflow drains.] To ensure some drainage from roof, do not test all drains at same time. Measure water at beginning and end of the 24-hour period. When precipitation occurs during test period, repeat test. When water level falls, remove water, thoroughly dry, and inspect installation; repair or replace roofing at drain. Repeat test until there is no water leakage.

]3.4.3 Instructions to Government Personnel

Furnish written and verbal instructions on proper maintenance procedures to designated Government personnel. Furnish instructions by a competent representative of the modified bitumen membrane manufacturer and include a minimum of 4 hours on maintenance and emergency repair of the membrane. Include a demonstration of membrane repair, and give sources of required special tools. Furnish information on safety requirements during maintenance and emergency repair operations.

3.5 INFORMATION CARD

****

NOTE: Include only the applicable Engineering Field Division.

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For each roof, furnish a typewritten card, laminated in plastic and framed for interior display, or a photoengraved 0.8 mm 0.032 inch thick aluminum

card for exterior display. Card shall be 220 by 280 mm 8 1/2 by 11 inches minimum and shall contain the information listed on Form 1 located at end of this section. Install card near point of access to roof, or where indicated. Send a photostatic paper copy to [LANTNAVFACENGCOM, Code 1613, 1510 Gilbert Street Norfolk, VA 23511-2699] [NORTHNAVFACENGCOM, Code 103A, 10 Industrial Highway, Mail Stop #82, Lester, PA 19113-2090] [PACNAVFACENGCOM, Code 102, Pearl Harbor, HI 96860-7300] [SOUTHNAVFACENGCOM, Code 0535, P.O. Box 190010, North Charleston, SC 29419-9010] [SOUTHWESTNAVFACENGCOM, Code 133SB, 1220 Pacific Highway, San Diego, CA 92132-5190].

FORM 1, ROOFING SYSTEM DESCRIPTION

1. Location _____ 2. Bldg. Name _____

3. Bldg. No. _____ 4. Roof Area (SF) _____ 5. Contract No. _____

6. New Construction: ( ) Yes ( ) No 7. Deck Slope: _____

8. Type of Deck:
   ( ) Metal ( ) Wood Plank or Plywood
   ( ) Cast-In-Place Concrete ( ) Other _____
   ( ) Precast/Prestressed Concrete

9. Type of Insulation Board:
   ( ) Polyisocyanurate/Composite ( ) Polyisocyanurate Foam
   ( ) Polystyrene/Composite ( ) Polystyrene
   ( ) Perlite ( ) Mineral Fiber
   ( ) Other _____

10. Insulation Manufacturer: _____

11. Insulation Thickness: _____

12. Vapor Treatment: Total coverage ( ) Yes ( ) No
    ( ) No Vapor Retarder ( ) Bituminous Vapor Retarder
    ( ) One Way Roof Vents ( ) Laminated Kraft Paper
    ( ) Other _____

13. Vapor Treatment Manufacturer(s): _____

14. Roofing Type:
    ( ) Built-Up (Asphalt) ( ) PIB ( ) TPA
    ( ) Built-Up (Coal-Tar) ( ) Modified Bitumen ( ) EPDM
    ( ) Metal ( ) CSPE ( ) PVC
    ( ) Shingles ( ) Other _____

15. Roofing Manufacturer: _____

16. Roofing Installer/Warrantor: _____

17. Roofing Application Method:
    ( ) Bitumen ( ) Fully Adhered ( ) Loose-Laid
    ( ) Mechanically Fastened ( ) Torched Ballasted
    ( ) Mechanically Fastened/Fully Adhered ( ) Other _____

18. Warranty Period: From _____ To _____

19. Warranty Serial Number: _____

20. Date Roofing Completed: _____ 21. Inspector: _____

22. Prime Contractor Name/Address: _____

Signature: _____ Date: _____

INSTRUCTIONS FOR FORM 1 (Do Not Post)

1. Location: Name of activity as shown on contract.

2. Bldg. Name: As shown on contract or as provided by Contracting Officer.

3. Bldg. Number: As provided by Contracting Officer.

4. Roof Area: Area in square feet of roof for which deck insulation, membrane, etc. are the same. A separate form is required if any part of roof system is different over other areas of the roof.

5. Contract Number: As shown on the contract.

7. Show deck slope.

8. Deck: Check appropriate block.

9. Type of Insulation Board: Check appropriate block.

11. Show minimum thickness of installed insulation.

12. Vapor Treatment: Check appropriate blocks.

13. Show vapor treatment system manufacturer's name.

14. Roofing Type: Check appropriate block.

15. Show roofing manufacturer's name.

16. Roofing Installer's or Contractor's name.

17. Roofing Application Method: Check appropriate block.

18. Warranty Period: Insert start and end dates.

20. Show date roofing was accepted by the Contracting Officer. Warranty period begins on this date.

21. Show Government Inspector's name.

22. Prime Contractor Name/Address/Signature: Must be signed and dated by [QC Manager] [an official of Contracting firm].

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NOTE: Suggestions for improvement of this specification will be welcomed using the Navy "Change Request Forms" subdirectory located in SPECSINTACT in Jobs or Masters under "Forms/Documents" directory or DD Form 1426. Suggestions should be forwarded to:

Atlantic Division
Naval Facilities Engineering Command
Attention EICO
1510 Gilbert Street
Norfolk, VA 23511-2699

FAX: (757) 322-4416 or DSN 262-4416
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-- End of Section --